Groundwater Compliance Monitoring Plan
Fenceline Area Soil Excavation
North Boeing Field
Seattle, Washington

August 22, 2012

Prepared for

The Boeing Company
Seattle, Washington

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INTRODUCTION

This Groundwater Compliance Monitoring Plan outlines the approach for follow-up groundwater monitoring as part of the implementation of the 2011 fenceline area interim action soil excavation project at North Boeing Field (NBF) in Seattle, Washington (Figure 1). The NBF fenceline area is located within the Propulsion Engineering Labs (PEL) area at NBF (Figure 2). The primary objective of the 2011 fenceline area soil excavation project was to remove accessible soil that contained concentrations of polychlorinated biphenyls (PCBs) greater than the interim action level (IAL), as required by the Washington State Department of Ecology (Ecology). The NBF interim action was conducted by The Boeing Company (Boeing) in conjunction with the soil excavation activities conducted by the City of Seattle (City) at the Georgetown Steam Plant (GTSP). The interim action soil excavation activities at NBF and the GTSP were conducted as a collaborative effort by Boeing and the City using one prime contractor and construction contract.

The proposed IALs for PCBs in soil and groundwater were developed in the *Fenceline Area Excavation Interim Action Work Plan* (Work Plan; Landau Associates 2011). Following soil excavation activities, all confirmation sample results representing soil remaining in place within the limits of the interim action excavation areas were less than the established IAL of 0.5 milligrams per kilogram (mg/kg) for PCBs in soil that is protective of groundwater. The groundwater IAL is discussed in the section below.

Groundwater monitoring wells NGW501, NGW502, NGW503, NGW504, and NGW507, all located within the fenceline excavation area, were found to contain total PCBs ranging from 0.032 micrograms per liter (µg/L) to 8.1 µg/L. The five wells listed above were decommissioned prior to implementation of the 2011 interim action soil excavation activities. All groundwater monitoring wells (both active and decommissioned) within the fenceline excavation area are shown on Figure 2.

Based on the previous groundwater monitoring results at wells NGW501, NGW502, NGW503, NGW504, and NGW507, this groundwater compliance monitoring plan was prepared to identify the location of groundwater compliance monitoring wells, the frequency of sampling, and the constituents for which samples will be analyzed. The results of groundwater monitoring will provide sufficient information to evaluate and document compliance with the Model Toxics Control Act (MTCA) and the groundwater IAL.

GROUNDWATER INTERIM ACTION LEVEL

As discussed in Section 2.1 of the *Fenceline Area Interim Action Completion Report* (Landau Associates 2012), the groundwater IAL for total PCBs was developed from the groundwater and surface water applicable or relevant and appropriate requirements (ARARs) as shown in Table C-2 of Appendix C of the Work Plan (Landau Associates 2011). The groundwater IAL for PCBs was less than the reporting limit (RL); therefore, the groundwater IAL for PCBs was adjusted upward to the RL in accordance with

MTCA [Washington Administrative Code (WAC) 173-340-720(7)(c)]. The IAL for groundwater is 0.01 µg/L total PCBs in groundwater.

GROUNDWATER COMPLIANCE MONITORING

The groundwater compliance monitoring program will include the installation of three additional groundwater monitoring wells, groundwater monitoring and sample collection at the three new wells, and laboratory analysis of groundwater samples. These elements are described in further detail below.

GROUNDWATER MONITORING WELLS

Groundwater compliance monitoring will be conducted using two new groundwater monitoring wells (NGW521, NGW522, and NGW523) installed downgradient of the GTSP and within the fenceline area interim action excavation boundary. Groundwater across the site generally flows to the southwest, toward the Duwamish Waterway, as shown on Figure 2. The proposed locations of the new groundwater monitoring wells, NGW521, NGW522, and NGW523, are shown on Figure 3.

The new monitoring wells will be constructed in accordance with *Washington State Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC). Landau Associates' field personnel will oversee the drilling and well installation activities, and maintain a detailed record of well construction. The wells will be installed utilizing a push-probe rig, unless subsurface obstructions are encountered that prohibit well installation by this method. All wells will be installed to the approximate planned depth of 15 ft using a 2-inch-diameter, flush-threaded, Schedule 40 polyvinyl chloride (PVC) well casing that includes a 10-ft 0.010-inch machine-slotted screen and a pre-fabricated filter pack. The filter material will consist of 20-40 Colorado silica sand or equivalent. A bentonite seal will be placed above the filter pack material to within about 3 ft of the ground surface. Grout will be used to backfill the borings to the subgrade for placement of the protective cover. The well installation depths, screen intervals, and sampling parameters are shown in Table 1.

The new groundwater monitoring wells, NGW521, NGW522, and NGW523, will be developed to improve the hydraulic connection with groundwater to obtain representative water samples and water elevations. The wells will be developed at least 24 hours after completion to avoid compromising the surface seal. The wells will be developed by appropriate combinations of surging, bailing, or pumping. The well names and the identification numbers assigned by Ecology will be marked on the well identification tags supplied by Ecology and will be attached to the well casings following well installation. Additionally, after installation, the well locations and casing elevations will be surveyed.

GROUNDWATER MONITORING WELL SAMPLING AND SAMPLE ANALYSIS

The new monitoring wells, NGW521, NGW522, and NGW523, will be sampled using a peristaltic pump and single-use polyethylene tubing. Low-flow sampling techniques [U.S. Environmental Protection Agency (EPA)/540/S-95/504] will be used. Samples will be collected directly from the

sampling equipment into laboratory-supplied containers and stored on ice in a cooler. Both filtered and unfiltered samples may be collected and analyzed for PCBs for data comparison. Groundwater samples collected from monitoring wells will be designated with the well number (e.g., NGW521) and the date the sample was collected in month-day-year format (e.g., NGW521-081512). The samples will be logged on a chain-of-custody form and submitted to an Ecology-accredited laboratory following proper chain-of-custody protocols. The transportation and handling of samples will be accomplished in a manner that protects the integrity of the samples.

Groundwater samples will be submitted to the laboratory and analyzed for PCBs by EPA Method SW8082, as shown in Table 1. The anticipated laboratory reporting limits are provided in Table 1.

EQUIPMENT DECONTAMINATION AND MANAGEMENT OF INVESTIGATION-DERIVED WASTE

All non-disposable sampling equipment will be decontaminated between uses. Downhole drilling and sampling equipment will be decontaminated between uses at each boring location. Any visible contamination will be removed with paper towels prior to decontamination. Soil and decontamination and purge water generated during the field activities will be contained in labeled drums for storage onsite pending the results of the laboratory analysis of the groundwater samples. Soil and water will be disposed appropriately at a permitted facility based on the analytical results for the groundwater samples and available soil analytical data from previous fenceline area sampling. Disposable equipment and clothing will be disposed as solid waste.

QUALITY ASSURANCE/QUALITY CONTROL

The accuracy of the data will be determined through recovery of spiked surrogates, matrix spikes, duplicates, and spiked laboratory control samples. Control limits for spike recovery will be laboratory acceptance limits generated according to EPA guidelines. Blind field duplicates will be collected at a frequency of 1 per 20 samples, or 1 per sampling event; thus, 1 blind duplicate sample will be submitted per groundwater sampling event. The duplicate will be collected by alternately filling sample containers for the original sample and the corresponding duplicate sample for every container filled to decrease the variability between duplicates.

REPORTING

Following completion of groundwater monitoring activities, and after receipt from the laboratory, the analytical results will be tabulated and subjected to a quality assurance/quality control review. The findings of the groundwater compliance monitoring activities will be incorporated into a compliance report for submittal to Ecology.

PROJECT SCHEDULE

The proposed installation and development of the new monitoring wells will take place following Ecology approval of this Groundwater Compliance Monitoring Plan. New well installation is anticipated to require about 3 days in the field. Sampling and analysis of the two monitoring wells is anticipated to require 1 day in the field for each sampling event. Receipt of the analytical results is anticipated approximately 2 weeks after sample submittal, based on a standard turnaround time from the laboratory. Compliance reports will be submitted to Ecology approximately 6 to 8 weeks following receipt of the final analytical data, according to the schedule presented below.

Sampling of monitoring wells and analysis of samples for PCBs will occur quarterly for one year. It is anticipated that the first sampling event will be in November 2012. This will coincide with the compliance monitoring to be conducted by the City at the GTSP and with the February and August semiannual groundwater sampling currently conducted at NBF. The need for continued monitoring in the fenceline area will be evaluated based on the groundwater analytical results at the completion of one year of quarterly sampling. If PCBs are not detected above the IAL in any of the four sampling events, groundwater compliance will have been demonstrated and routine groundwater monitoring will cease. In the event that PCBs are detected at concentrations greater than the IAL in one or more of the wells, semi-annual groundwater monitoring will be conducted for one year with subsequent re-evaluation of the need for continued monitoring. After four consecutive events with total PCBs concentrations at or below the IAL for groundwater, monitoring will cease.

* * * * *

This document has been prepared under the supervision and direction of the following key staff.

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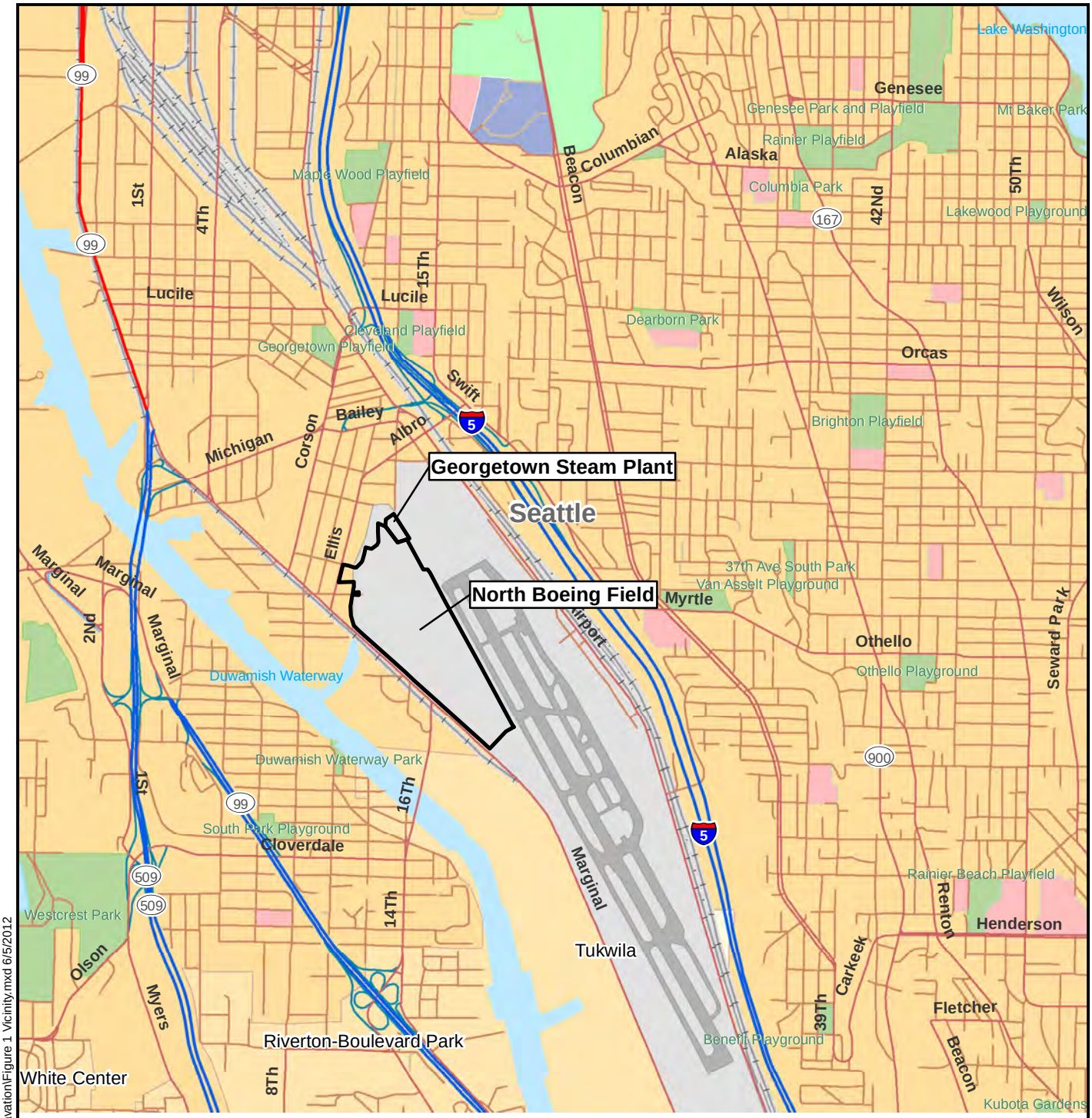

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0 0.5 1

Miles

Data Source: ESRI 2008

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North Boeing Field Seattle, Washington	**Vicinity Map**	Figure 1

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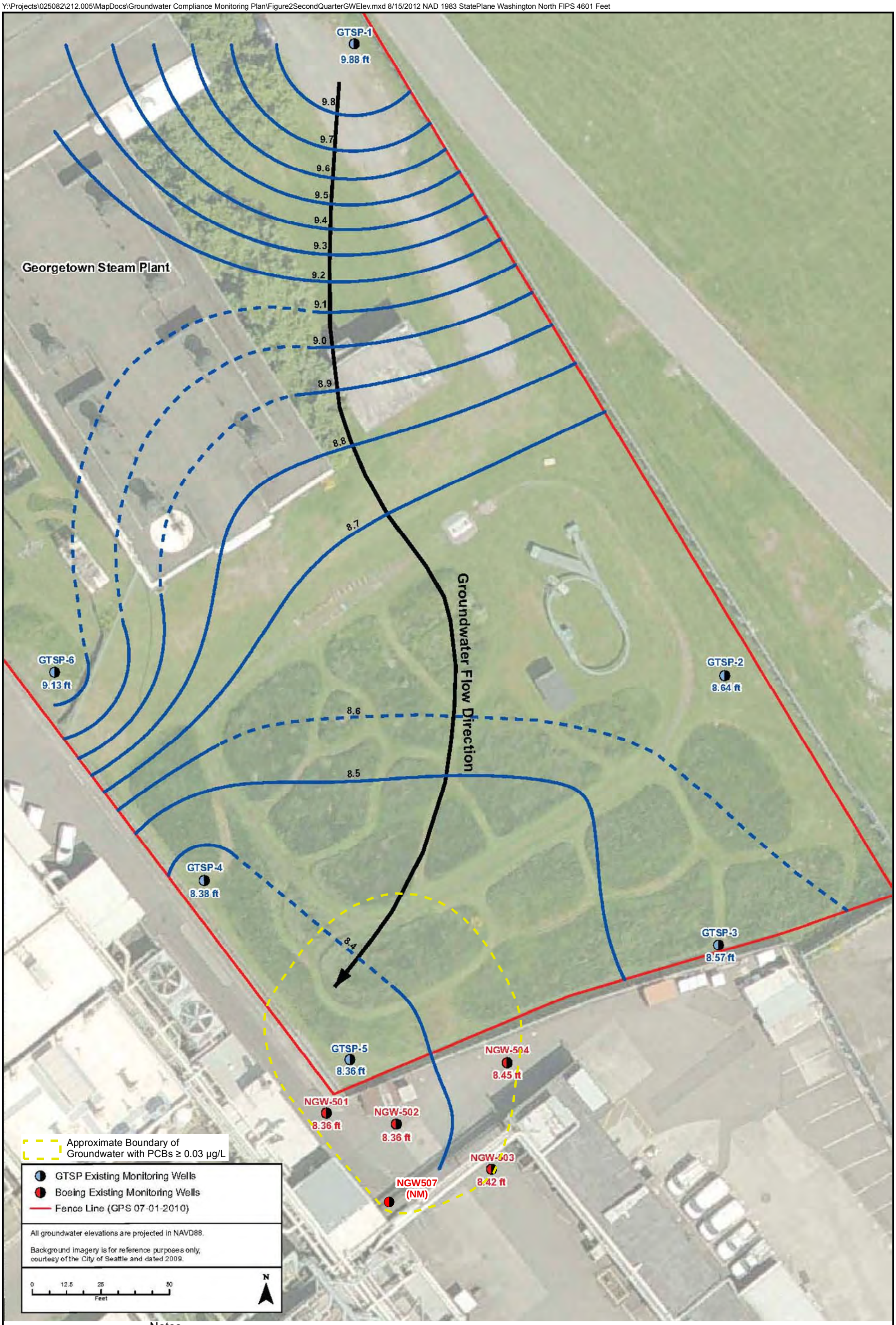

Notes

1. Figure from Integral Consulting Inc., Figure 2-3, Georgetown Steam Plant Interim Action Work Plan.
3. NM = Not Measured.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Figure Source: Integral Consulting

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North Boeing Field Seattle, Washington	**Second Quarter 2010 Groundwater Elevation Contours (August 30)**	Figure 2

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Legend

- Proposed Groundwater Monitoring Well
- Abandoned Groundwater Monitoring Well
- North Lateral
- PEL Boundary
- Approximate Boundary of Groundwater with PCBs ≥ 0.03 µg/L

0 30 60

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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North Boeing Field
Seattle, Washington

Proposed Fenceline Area Interim Action Compliance Monitoring Well Locations

Figure 3

TABLE 1
SAMPLING LOCATION AND ANALYSIS MATRIX
NORTH BOEING FIELD
SEATTLE, WASHINGTON

Sample Location	Sample Depth/ Screened Interval	Drilling Method for Well Installation	Analysis PCBs
NGW521	5 to 15 ft	Push Probe	✓
NGW522	5 to 15 ft	Push Probe	✓
NGW523	5 to 15 ft	Push Probe	✓

PCBs = Polychlorinated Biphenyls by Method 8082; RL is 0.01 µg/L for each aroclor